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Adaptive Agent Real M-Business Framework for 5G Wireless Worlds

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***Abstract*—We integrate the current existing e-business model and the 5G real wireless networks to propose a new real m-business model for the requirements of mobile business in future. The mobile business model will be measured through creating a simulation system. As the wireless computing landscape moves from the Internet to mobile communication systems, the need for a consistent, reusable, open agent-based m-business organization that will create dynamically in a recursive way to automate m-business transactions and meet future requirements without expensive new implementations, while at the same time decreasing time to market by using corporate load balancing and transformation strategies among different agent organizations.**

***Index Terms*—5G real wireless networks, simulation system, agent-based m-business organization, corporate load balancing, transformation strategies.**

I. Introduction

The world is exposed to a rapid chain of changes inspired by new technologies, sharp competition and changing rules of doing business. Innovation in its self is not enough to maintain a market lead. First, new technologies cannot guarantee new market value. Secondly, new markets take time to absorb new technologies based on market readiness. This occurred as mobile commerce (or m-business) made its debut in the world. The advances in mobile technologies and the introduction of the 4G devices brought hope for users and challenge for vendors, operators, and service providers. The hope resides in enhanced communication capabilities, new communication styles enriched with visual content while the challenge resides in the need for new forms of communication, a wide range of value added services and personalized applications in which demands exceeds in an order of magnitude current business opportunities.

The 5th generation networks will be completed wireless communication networks, which bring us a real wireless world - world wide wireless web. We integrate the current existing e-business model and the 5G real wireless networks to propose a new business model for requirement of mobile business in future. The mobile business model will be measured through creating a simulation system.

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The exponential growth of the Internet and the proliferation of cellular mobile systems and WLAN systems throughout both home and business applications generated both competition and cooperation among the different systems i.e. (Abdullah Gani, et al. 2008)[13].

In the near future, multimedia applications which are mainly achieved by wired and fixed internet users will be achieved by mobile internet users as well (Al-Shawabkeh, et al. 2007)[14].

Mobile business allows delivering any service to any location at any time with greater flexibility and efficiency than e-business. We use the definition of Durlachar Research Ltd [4], which defines m-commerce as any transaction with a monetary value (direct or indirect) that is conducted over a wireless network. M-business [9] is the ability to perform business transactions involving the exchange of information, goods, services, and payments between two or more parties using mobile telecommunication networks.

The personalized, continuously running, and semi-autonomous properties of software agents make them well suited for m-business applications [2] representing the interests of customers, suppliers, or intermediaries [3]. Conventional e-business models [7] can not be adapted for studying the roles of agents as mediators in m-business because those models are built upon functional components, such as marketing, shopping, ordering, fulfillment, and customer relationship management. For each functional component different applications, infrastructures, and systems are put in place. Instead we study the roles of agents as mediators in m-business in the context of a common model that cuts across all disciplines involved in m-business [9], such as marketing, computer science, consumer behavior, management, business law, and ethics. Such a model provides the tools, necessary to understand the relationships and interactions between different functional components.

Intelligent software agent technology is the latest innovation of the distributed artificial intelligence research field and when many manufacturers and system developers adopted it, the need for a consistent, reusable and open framework arose. Agents are simultaneously considered according to two different levels: a functional and a structural level. In the functional level, we have three types of agents: task agents, information agents and interface agents assuming task's fulfillment through cooperation, information gathering tasks, and mediation between users and artificial agents respectively. In the structural level we have elementary agents based on a generic reusable

architecture and complex agents considered as an agent organization that is created dynamically in a recursive way.

As a new business model, e-business is an evolution of relationship between customers and sales companies. Customers make purchase are not based on real product, but specification of the products. The sales companies establish connectivity between customers and database of their products. This new relationship drives a new evolution of infrastructure management and financial aspects for sales companies. Therefore, customers' relationship, infrastructure management and financial aspects are main challenges for e-business (Mutula and van Brakel, 2006). These challenges will be solved by new technologies in future. The next generation wireless mobile multimedia internet networks integrate with current existing cellular networks, Wi-Fi networks and fixed internet networks to supply mobile multimedia applications for customers.

In mobile business mode, multimedia networks are a real-time wireless system. Customer can visit not only the store of sales companies, but also the manufactures of any product that customers want. The processing for the products are visible and the function of the products are introduced by engineer. The products design can be visible and introduced as well, even in virtual companies (Business Process Modeling Notation, 2008). In mobile business mode, customer can make purchase much more convenient and easy (Anderson, et al. 1998). Mobile devices are much cheaper than computer and they can move freedom.

II. Recent Work

Nowadays, wireless technology is getting popular and important in the mobile telephone network and the Internet field which have altered the industry and people's life (3GPP2, 2006)[15]. Actually, in their beginnings of usage, Internet and mobile telephone were primarily limited to academic and scientific institutions because of high cost. Today, the widespread use of the Internet for communications, file transfer and World Wide Web (WWW) connectivity is commonplace for most business and home users. Just as there has been an unstoppable growth in the Internet, the number of mobile telephones has similarly advanced at an amazing pace.

Mobile networks have experienced three generations of its life (3GPP2, 2006) [15]. The first generation is an analog system which is to be used for public with voice service only; the second generation is based on digital technology, which can support text messaging. Its success and the growth of demand for online information via the Internet prompted the development of mobile wireless systems with improved data connectivity, which ultimately lead to the latest third generation (3G) systems. For third generation networks, although the coverage and the quality of the services both have increased dramatically, but as it was not within the original scope of the design of mobile networks, indoor coverage and data capacity are still significantly limited. WLAN systems were designed for indoor, data traffic and have demonstrated their ability support the needs of limited mobility indoor clients. For these reasons, many supported the eventual convergence of the two communications networks to provide better services such as larger capacities and higher data rates and improved coverage for their users (Jatinder Pal Singh, et al. 2007). The standards developing bodies attempted to define standards for the interoperation of the two systems (Yu Zheng, et al. 2005) and several researchers thought to determine the best methods to interwork the two systems (Xichun Li and Rosli Salleh, 2007).

As the mobile telephone and Internet proliferate, researchers and service providers have attempted to integrate them. These attempts to integrate data services into mobile networks have brought the limitations of both the Internet and the mobile network into sharp focus. The Internet's best effort model is limited in its ability to support the real time constraints of a voice conversation. While, the mobile telephone network's low data rate is not sufficient for web browsing or large file transfers. Ongoing research is aimed at improving Quality of Service (QoS) for the Internet and increasing data rates on mobile networks (Rosli Salleh, et al. 2008). The 3 Generation (3G) wireless mobile internet networks have ready to live up to its performance in computer networking and mobile device area, which is limited access voice quality and up to 2M bit/sec for data rates. The 4th Generation (4G) wireless mobile internet networks combine current existing 3G cellular networks and Wi-Fi networks with fixed internet to support wireless mobile internet as the same quality of service as fixed internet, which is an evolution not only to move beyond the limitations and problems of 3G, but also to enhance the quality of services, to increase the bandwidth and to reduce the cost of the resource. The 5th wireless mobile internet networks are completed wireless communication without limitation.

All decision making tasks that include some or all of the characteristics considered in the literature, Jennings et al. (1996), Sycara and Zeng (1996) can be supported by information systems that are developed according to the proposed software agent framework. These characteristics are: a) the inherent distribution of problem solving abilities (the agents perform different tasks and methods), data, information, b) the necessity of flexibility, modularity (agents can appear and disappear in the system without disturbing its functionality) and reusability (customization of agents for new decision makers), c) problem solving complexity involving coordination between actors expressing different points of view.

Agents are considered simultaneously according to two different levels: a functional level and a structural level. In the functional level, we have a natural distinction between three different agent's functionalities: the information gathering task, the task's fulfillment by different types of cooperating specialists and the mediation between users and artificial agents, in order to allow users to control the actions of their agents. Therefore, we consider three types of agents as did Sycara and Zeng (1996): interface agents, information agents and task agents. In the structural level agents are considered as elementary agents and complex agents. We

consider that complex tasks can be decomposed in a recursive way in several subtasks. In a similar way an agent structure can be considered according to different nested layers created in a recursive way. We can imagine a complex agent as a "Russian doll". The agent's layers are related to the subtasks that are carried out. This conception is inspired by the representation of a complex system through multiple layers proposed in control theory Mesarovic et al. (1970). Therefore, an agent is considered as a complex one when he realizes a task involving several agents of at least one lower layer. An agent is considered as an elementary one, if he realizes a primitive task. From a methodological point of view, we believe that this consideration facilitates the conception and the design of complex systems of multiple intelligent software agents, in order to achieve the modeling of complex real applications. Besides, this field of research addresses the security models needed for an agent-based community (Raybourn et al., 2002; Camarinha-Matos et al., 2003; Page et al., 2004; Spyrou et al., 2004; Malik et al., 2005; O'Sullivan and Studdert, 2005; Chhetri et al., 2006).

III. Categories Of Mobile Virtual Communities

A. Degree of 'openness' (private/public):

A private MVC is open to its members only; communication can happen only between the community members. A public virtual community is open to nonmembers, who can participate in communication occurring within the community. For example, newsgroups can be considered 'open' communities, while private mail-groups, where communication occurs only between group members, can be considered 'closed' communities.

B. Degree of contextual information present (contextual/non contextual):

Contextual information refers to data that reflect the context in which the member is immersed. Such information can be reflected by one or more of these three – location, speed, or direction. For example, newsgroups and mail-groups are not context-aware communities, while tourism-based communities are context-aware.

C. Degree of interaction they permit (synchronous/asynchronous):

In a synchronous interaction, the members are required to be simultaneously present when interacting. In an asynchronous interaction, the communication of members occurs in a deferred way. A well-known example of a synchronous community is a chatting community, which at the same time can be public or private (private chat rooms). Billboard communities are examples of asynchronous communities.

IV. Perspectives & Problems

We suggest some perspectives regarding the research in the field of Mobile Virtual Communities:

A. User Interface

With the exception of a few cases (Hampe et al., 2004; Rantanen et al., 2004; Kawash, 2003), most research papers that investigated MVCs did not engage in exploring the UI problems incurred in mobility. A UI requirement in MVCs is still a research domain that needs to be further explored. One important factor that remains to be considered is user expectations in terms of usability and personalization. Another research question is UI portability. Apart from the use of XUI (Xoetrope Website, 2006), UI portability will continue to be a challenge, given the exploding mobile device market, the emerging interactive TV and other ubiquitous technologies.

B. Mobile Agent Support

Even though mobile agent technologies can be used for mobile communities, we pointed out earlier in this paper that the work concerning mobile agents mainly dealt with the platform architecture and security issues. Furthermore, some researchers dealt with agents to provide services for mobile but independent (not necessarily linked to a community) users (Moreno and Isern, 2002). More recent papers suggest using mobile agents in support of nonmobile communities of practice (Silva Santos et al., 2005). They fall short of tackling the mobility component, from a mobile-agent-based community perspective or from a mobile-agent platform design perspective. Developments in these directions are yet to be made.

C. User Requirements

The behavior of mobile users is likely to be different from that of non-mobile users, and the communication means available to these separate categories of users are not necessarily the same. The research focus on technology was usually disconnected from the users' requirements elicitation. Yet mobility is not a need that is well defined; it is not a de facto need as shown in some papers' findings (Burak and Sharon, 2004; Tasch and Brakel, 2004). Mobile Market Research Communities will allow product testing on the spot and allow the members to share their experiences, likes and dislikes. This information can be shared to other members of the community, thus giving instantaneous ratings of the products based on the consumer experience. Such business orientation is already online (Turban et al., 2005), though mobility will elevate it to a higher degree of availability owing to mobile notification.

V. Adaptive Agent

An agent will be informed when a new member enters his community or when another leaves. During the problem solving process, appropriate agents activation dynamically forms an organizational structure that fits with the current goal. In our approach, interface agents activate task agents. Activities of information agents are initiated, either top down by a user or a task agent through queries, or bottom up through monitoring information sources for particular information. he interface agents can receive

messages/queries from users.

The architecture of a complex agent is similar to the one of an elementary agent. Therefore he is composed of the same three modules (Communication, Planning and Reasoning module) which intercommunicate through internal message exchanging. The intra-agent control (interaction between the three components) is the one of the elementary level. The difference is situated in the structure of the reasoning module. The group of agents (elementary and/or complex) which compose it assumes its role. The task achievement of an agent (parent) developed in n-layer is therefore the result of the set of agent's (his descendants) cooperation belonging to the previous (n-1) layers. The reasoning module could be therefore considered as an agent organization.

The architecture adopts a hybrid agent network topology that makes use of a unique feature called the Matrix-agent connection. The novel component, i.e. Matrix, provides a living environment for agents; it allows agents to upgrade themselves through interacting with the Matrix in the unified Matrices structure. The proposed framework is able to enhance the system reusability and maximize the system performance. By using a set of interoperable autonomous agents, more creative decision-making can be accomplished in comparison with a hard-coded programmed approach. Furthermore, a novel topological description language for agent networks (TDLA) has been introduced in this research work, which provides an efficient mechanism for agents to perceive the information about their interconnected network. A new Agent-Rank algorithm is introduced in the thesis in order to provide an efficient matching mechanism for agent cooperation and re-matching for processes

The starting point for the language is the agent society pattern, which motivates the use of agents for building the application. At the next level of refinement, the diagram leads the designer to consider the patterns agent as delegate, agent as mediator, and common vocabulary. The key contribution of an intelligent software agent framework and architecture consists of neural networks adopted by fuzzy logic algorithms that provide facilities for:

1) Merging Information from Heterogeneous Sources: Due to the vast amount of information available on the Internet software agents will soon be overwhelmed by inconsistent information if they are unable to integrate information in a rational fashion.

2) Dealing with Change in a Dynamic Environment: Due to the changing nature of the market space software agents must be able to cope with changes in consumer behavior, consumer preferences and product choices.

3) Handling Decisions that Need to Be Made With Information That Is Incomplete And/Or Uncertain. Software agents must be able to respond in the market space even when they do not possess all the necessary information. We envisage that our intelligent software agents would inhabit a market space where they work for the benefit of consumers and businesses engaged in customer-to-business and business-to-business electronic commerce

VI. Proposed Real M-Business Model And Value Chain

The advance in wireless communication market enables users to experience enhanced delivery of personalized services through the integration of various radio technologies. However, the existing management platforms cannot ensure the scalability and reliability for the interworking of different networks. Therefore, the need for research activities in network management by developing and validating flexible framework of orientation that guides the design of interactive mobile systems in terms of awareness tools for the support of heterogeneous infrastructures is apparent.

Intelligent agents, which consists of bringing the computation to data rather than data to computation, has a tremendous impact on mobile network technology since it helps to overcome shortages in a mobile network such as low bandwidth and short network disconnections. Besides, this field of research addresses the security models needed for an agent-based community and in conceiving new protocols to access computing resources and appropriate network services

5G Wireless Solutions products are distinguished by their exceptional service area range, throughput speeds, number of concurrent users, non-line-of-sight (NLOS) capabilities and unique security protocol. These enhancements are compatible with standard IEEE 802.11b Wi-Fi equipment for "last mile" roaming by critical new protocol Mobile IP and point-to-multipoint networks supported by IPv6 transmission protocol, OFDM, MC-CDMA, LAS-CDMA, UWB *7 and Network-LMDS. By implementing standard IETF protocols into this test bed, we have demonstrated the basic functionalities required of the mobile wireless Internet to successfully support mobile multimedia access. These requirements include signaling, registration, dynamic configuration, mobility binding, location management, Authentication Authorization and Accounting (AAA), and quality of service over a variety of radio access network (RAN) technologies (e.g. 802.11b, CDMA/GPRS) 5G's value proposition -- significantly increased performance at the lowest possible total cost of ownership (TCO) -- is quickly becoming a key consideration in the strategic deployment of the wireless experience.

A. Real M-Business Model

The technology-centered interest involves research in the areas of platform design, development frameworks, bandwidth limits and intelligent agents. The user-centred interest comprises UI, behaviour, personalization, privacy, security and trust. The business-centred interest is concerned with marketing and finding the right business model that will prove to be lucrative for the communication companies.

The model comprises the five main dimensions of m-business i.e. the technology, business, services, interoperable and organizational dimensions [1]. For each dimension, we explore the main issues that are necessary to understand the relations and interactions among different components of m-business. This will set up the environment

to identify where agents play important roles in the integral value added chain of m-business. E-business model is made with four components. They are product innovation, customer relationship, infrastructure management and financial aspects.

We combine the next generation mobile multimedia internet networks and e-business model to propose mobile business model drives new economy and business; Modeling helps firms develop business visions and strategies, redesign and align business operations, share knowledge about the business and its vision and ensure the acceptance of business decisions. Therefore, a business model is nothing else than the architecture of a firm and its network of partners for creating, marketing and delivering value and relationship capital to one or several segments of customers in order to generate profitable and sustainable revenue streams. However, customer is a key component in the mobile business model, not firm profit. Furthermore, transaction is main processing in the model.

Mobile business model is based on mobile multimedia internet (MMI). The mobile multimedia is a research item for next generation wireless systems. Therefore, the mobile business model can be measurement on network simulator with extensive model library sets. It will simulate designed model in a controlled environment. For example; in the testing system, Node0 denotes to product revolution, Node1 denotes to customer relationship, Node2 denotes to MMI and Node3 denotes to financial aspects. Such a value network describes the creation and exchange of value through the interaction between actors, characterized by different relationships and hierarchies, within a networked environment. If these interactions are repeated and become recurrent, relationships and linkages are formed. These relationships allow the different actors to combine their productive and innovative potential. These elements provide the main components for the construction and analysis of a mobile business model for real wireless networks.

B. Value chain or Value Network Deconstruction

1) Identification of services and their characteristics.
2) Identification of actors, interaction patterns, and hierarchies.
3) Value chain or value network reconstruction: the integration of the different actors and interaction patterns to form a commercially viable business model.
4) Assessing the impact of future trends and developments on the business models.

Identifying value propositions, capabilities, resources and the supporting relationships between them results in the creation of a network of interrelated business capabilities supporting the firm's value propositions and supported by the firm's resources. This network model of the firm allows for the visual depiction of strategic features such as strategic alignment, synergy, network effects, and leverage of core capabilities. In the context of model of a firm, an m-business building block is a collection of capabilities that a firm develops through the deployment of m-business technologies, especially those made popular and cost effective through the growing use of the real wireless Internet.

VII. Implications Of The Proposed Research

The real m-business enterprise will use to adapt business intelligence, m-customer relationship management, sales force automation, field force automation, and m-supply chain management. We'll look at m-business strategy and how to calculate return on investment. We'll look at m-business architecture and implementation, and profile some of the key wireless software vendors, in order to execute on the strategy.

We'll look at future trends in m-business and other emerging technologies such as the semantic Web, real-time computing, Web services, natural language processing, and business process management. All these emerging technologies are helping us adapt technology around ourselves and our business activities—enabling us to increase our business agility.

This can be considered as the theoretical end-state beyond m-business, where companies are on an equal footing in terms of their leverage of technology and are forced to compete solely on intellect corporate strategy and transformation strategy. The "i" can be considered as standing for intellect, ideas, and innovation. The corporation is entirely virtual and, yes, business decisions can be executed at the speed of thought. The transformation strategy based on the operator's specific business strategy in which each strategic transformation area should provide task definition and goals, solution proposal, measuring delivered real business value and implementation plan with right choice.

• Proposed research implication in leveraging this data through modeling to predict customer behavior (risk, revenue, attrition). Use a disciplined approach to test decision strategies and create a loop of continuous improvement (champion/challenger, experimental design)

• Proposed research framework implication follows the methods assess innovative value based on customer patterns balance multiple objectives and real constraints, which provide a complex, set of choices—and in turn, large payback for making the best choice.

In summary, every business will become a real m-business. This simply takes time. The ability to pull value of information containing enriched contents and transactions from "edge" employees in areas of sales, marketing, and m-customer service and to push decision strategies ensure that our functional transformation and corporate strategies all take real m-business solution. The credit and transaction services company will have the opportunity to provide these real value services for the wireless carrier on behalf of their content providers using adaptive agent based real m-business framework. Additionally, their extensive loyalty and database marketing information from their existing customer base can be leveraged for greater customer personalization when conducting real wireless transactions.

By understanding the current M-Business value chains that are being formulated and the realm of possibilities for

future value chain configurations, we can best plan our next move. Ask what role your company might be able to play in these new value chains. How easy would it be to enter and defend this position? Who are the other entrants? Do they have the core competency and the brand recognition to accomplish the task? How can your companies' core competencies be leveraged in these new areas? What are the needs of your customers? How do they view these new value chains and how do they extract value from the products or services delivered? What alliances do you have that can be leveraged to create an entirely new value proposition for your customers?

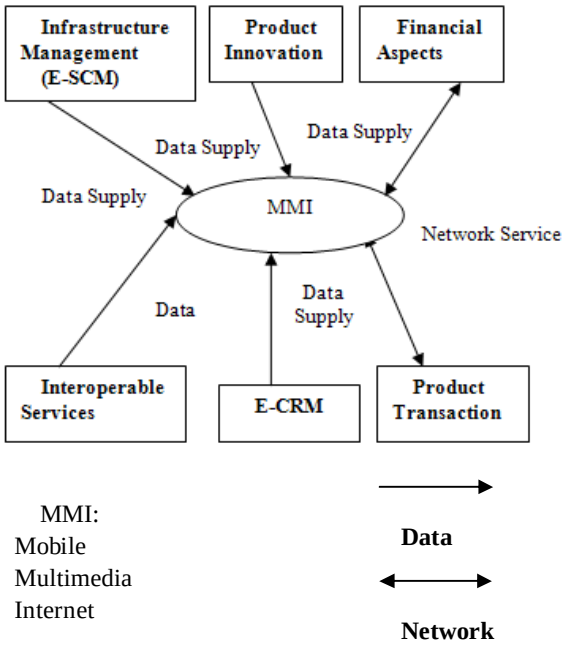

Figure 1. Real M-business Model

VIII. Conclusion

The work carried out in the entire investigation will be vividly discussed in this chapter in this sequence and in chronological order. The mutual comparison of m-business methodology and strategies shall be depicted and their importance will be highlighted for various topographies. The work which is at blueprint stage will be described as guidelines for the engineers engaged in the setting of adaptive agent based m-business framework

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